

WHAT IS CLAIMED IS:

1 1. A vascular filter guide wire for directing placement
2 of a catheter with respect to a blood vessel lesion and
3 filtering particulate matter dislodged by treatment of said
4 vessel, said guide wire including:

5 an elongated flexible core wire having a proximal end
6 and a distal end for insertion and steorage through a patient's
7 vasculature to a position downstream of said lesion;

8 a tubular flexible shaft slidably disposed along said
9 core wire, said shaft including a proximal portion and a distal
10 portion disposed proximally of said core wire distal end for
11 placement downstream of said lesion; and

12 a collapsible filter coupled at its proximal end to
13 said distal portion of said shaft and at its distal end to said
14 core wire, said filter operable in response to the relative
15 displacement between said shaft and said core wire to radially
16 extend outwardly within said vasculature and trap particulate
17 matter arising from the treatment of said lesion.

1 2. A vascular filter guide wire according to claim 1 and
2 further including:

3 a locking mechanism to maintain said filter in a
4 deployed position for particulate filtration during lesion
5 treatment.

1 3. A vascular filter guide wire according to claim 1
2 wherein:

3 said core wire includes a filter housing for confining
4 said filter in a closed configuration.

1 4. A vascular filter guide wire according to claim 3
2 wherein:

3 said housing is formed in a frusto-conical
4 configuration and axially disposed on said core wire, said
5 housing including an oversized-in-diameter mouth opening axially
6 outwardly from said wire distal end, and a reduced-in-diameter
7 collar radially fixed to said core wire proximate said distal
8 end.

1 5. A vascular filter guide wire according to claim 3
2 wherein said strainer is formed to collapsibly engage said
3 housing in a closed state and including:

4 a plurality of radially spaced apart support struts
5 defining a cage, said struts collapsibly hinged at one end along
6 a common radial path on said shaft and interconnected through a
7 woven peripheral mesh; and

8 a biasing element interposed concentrically between
9 said struts and said shaft to bias said struts radially
10 outwardly in an open state.

1 6. A vascular filter guide wire according to claim 5
2 wherein:

3 said spaced apart struts are disposed radially
4 equidistant.

1 7. A vascular filter guide wire according to claim 5
2 wherein:

3 said spaced apart struts are disposed in a spiral
4 relationship.

1 8. A vascular filter guide wire according to claim 5
2 wherein:

3 said struts are formed of a high elastic material.

1 9. A vascular filter guide wire according to claim 5
2 wherein:

3 said woven mesh comprises a polymeric material.

1 10. A vascular filter guide wire according to claim 5
2 wherein:

3 said woven mesh density is in the range 40 to 500
4 micrometers.

1 11. A vascular filter guide wire according to claim 5
2 wherein:
3 said biasing element comprises a quad filar spring.

1 12. A vascular filter guide wire according to claim 1,
2 further including a deployment/retraction mechanism including:
3 a removable base formed with a threaded passage for
4 confining the proximal portion of said shaft; and
5 a manually rotatable control element, said control
6 element formed with a threaded hollow shank and mounted to the
7 proximal end of said wire, said control element operable to
8 threadably engage said passage and incrementally urge relative
9 axial displacement between said shaft and said wire to extend
10 and retract said filter.

1 13. A vascular filter guide wire according to claim 1
2 wherein said filter includes:
3 a cylindrical support cage having a closed distal end
4 and a flared proximal end, said distal end fixed to the distal
5 extremity of said shaft, and said proximal end extending axially
6 and mounted to said core wire distal end; and
7 a continuous woven mesh having a plurality of
8 longitudinal pleats and disposed within said support cage for
9 straining particulate matter.

1 14. A vascular filter guide wire according to claim 13
2 wherein:
3 said filter is formed with oppositely disposed cone-
4 shaped ends to define said front and back halves.

1 15. A vascular filter guide wire according to claim 14
2 wherein
3 said woven mesh is mounted to said cage back half.

1 16. A vascular filter guide wire according to claim 13
2 wherein:
3 said woven mesh comprises a material from the group
4 including stainless steel and nickel-titanium alloy.

1 17. A vascular filter guide wire according to claim 13
2 wherein:
3 said wire mesh density is in the range 40 to 500
4 micrometers.

1 18. A vascular filter guide wire according to claim 1
2 wherein said filter includes:
3 a braid comprising a composite metallic/polymeric
4 material, said material including
5 a plurality of metallic filaments mounted to said
6 respective shiftable shaft and core wire to define a
7 support structure and
8 a polymeric mesh interwoven with said metallic
9 filaments to define a strainer.

1 19. A vascular filter guide wire according to claim 18
2 wherein:
3 said metallic filaments have respective common
4 proximal and distal halves; and
5 said polymeric mesh is interwoven in said distal half
6 of said metallic filaments.

1 20. A vascular filter guide wire according to claim 18
2 wherein:
3 said metallic and polymeric filaments are woven at a
4 ratio of approximately 1:4.

1 21. A vascular filter guide wire for directing precision
2 placement of a catheter with respect to a lesion and filtering
3 particulate matter dislodged by treatment of said lesion, said
4 guide wire including:
5 an actuating mechanism;
6 an elongated flexible core wire having a proximal end
7 attached to said actuating mechanism and a distal end for
8 insertion and steerage through a patient's vasculature to a
9 position downstream of said lesion;
10 a tubular flexible shaft slidably disposed along said
11 core wire, said shaft including a proximal portion affixed to
12 said actuating mechanism in movable relation to said wire, and a

13 distal portion disposed inwardly from the distal end of said
14 core wire for placement downstream of said lesion;

15 a locking mechanism to maintain said filter in an
16 extended position during lesion treatment; and

17 a collapsible filter coupled to said shaft distal
18 portion, said filter including a collapsible support cage having
19 respective front and back halves for slidably extending and
20 retracting axially along said wire, said cage having a first end
21 fixed to the distal extremity of said shaft, and an opposite end
22 mounted to said core wire distal end, said strainer further
23 including a continuous woven mesh disposed within said support
24 cage for straining particulate matter and operable, in response
25 to manual manipulation of said actuating mechanism to effect
26 relative displacement between said shaft and said core wire, to
27 radially extend outwardly within said vasculature and trap
28 particulate matter arising from the treatment of said lesion.

1 22. A catheter system for treating a blood vessel lesion
2 within a vasculature, said catheter system including:

3 a catheter having a lesion treatment device; and

4 a vascular filter guide wire for directing said
5 balloon catheter to said lesion, said guide wire including a
6 collapsible filter for manual deployment downstream of said
7 balloon catheter to trap particulate matter arising from the
8 treatment of said lesion.

1 23. A catheter system according to claim 22 wherein said
2 vascular filter guide wire includes:

3 an elongated flexible core wire having a proximal end
4 and a distal end for insertion and steerage through a patient's
5 vasculature to a position downstream of said lesion;

6 a tubular flexible shaft slidably disposed along said
7 core wire, said shaft including a proximal portion and a distal
8 portion disposed inwardly from said core wire distal end for
9 placement downstream of said lesion; and

10 a collapsible filter coupled at one end to said shaft
11 and at its other end to said core wire, said filter operable in
12 response to relative displacement between said shaft and said
13 core wire, to radially extend outwardly within said vasculature

14 and trap particulate matter arising from the treatment of said
15 lesion.

1 24. A method of filtering particulate debris from a
2 vasculature caused by treatment of a lesion with a lesion
3 treatment device, said catheter guided to the location of said
4 lesion by a vascular filter guide wire having a core wire, a
5 slidable shaft, and a manually collapsible filter mounted on the
6 shaft and deployable upon relative displacement between said
7 core wire and said shaft, said method including the steps of:

8 guiding said vascular filter guide wire through said
9 vasculature along a predetermined path to a lesion such that
10 said filter is disposed downstream of said lesion;

11 deploying said filter radially outwardly by shifting
12 said shaft relative to said core wire;

13 running said catheter over said guide wire along said
14 predetermined path to position said lesion treatment device
15 proximate said lesion;

16 treating said lesion according to a predetermined
17 procedure;

18 maintaining said filter in a deployed position to trap
19 particulate matter dislodged during said lesion treatment and
20 prevent said matter from progressing downstream;

21 withdrawing said catheter from said vasculature;

22 retracting said filter radially inwardly by shifting
23 said shaft back to said original position; and

24 removing said guide wire from said vasculature.

1 25. A vascular filter for controllably expanding within a
2 blood vessel to trap particulate matter loosened from a lesion,
3 said filter responsive to relatively shiftable control elements
4 to expand and retract, said filter including:

5 a braid comprising a composite metallic/polymeric
6 material, said material including

7 a plurality of metallic filaments mounted to said
8 respective shiftable shaft and core wire to define a
9 support structure, and

10 a polymeric mesh interwoven with said metallic
11 filaments to define a strainer.

1 26. A vascular filter guide wire according to claim 25
2 wherein:

3 said metallic filaments have respective common
4 proximal and distal halves; and

5 said polymeric mesh is interwoven in said distal half
6 of said metallic filaments.

1 27. A vascular filter guide wire according to claim 25
2 wherein:

3 said metallic and polymeric filaments are woven at a
4 ratio of approximately 1:4.

1 28. A method of fabricating a vascular filter, said method
2 including the steps of:

3 selecting a mandrel having a plurality of
4 consecutively connected forms;

5 weaving a continuous layer of braid over said
6 consecutively connected forms;

7 bonding said braid filaments at spaced apart sections
8 between respective forms;

9 separating said respective braided forms at said
10 bonded sections; and

11 removing said forms from said layer of braid.

1 29. A method of fabricating a vascular filter according to
2 claim 28 wherein said step of weaving includes:

3 forming a layer of braid over the proximal and distal
4 halves of each form with a composite metallic/polymeric material
5 to having a pic density sufficient to strain particulate matter.

1 30. A method of fabricating a vascular filter according to
2 claim 29 and further including the step of:

3 cutting said polymeric filaments from said proximal
4 halves of each form; and

5 fusing the ends of said cut filaments to form a
6 collection cavity around each form.

1 31. A method of fabricating a vascular filter according to
2 claim 28 wherein after said bonding step, said method further
3 includes the steps of:

installing a filter layer over each form;
weaving a second continuous layer of braid having a plurality of second braid filaments over said installed filters;
and

bonding said second braid filaments at said spaced apart sections.

32. A method of fabricating a vascular filter according to claim 28 wherein said forms are molded from a dissolvable material, said step of removing including:

dissolving said forms by an appropriate solvent.

Variable	Mean	SD	Min	Max	Median	Q1	Q3	Mode	Skewness	Kurtosis	Shapiro-Wilk	Normality
Age	35.2	12.5	18	65	32	25	40	30	0.15	2.5	0.95	Normal
Gender	1.2	0.4	1	2	1	1	2	1	0.05	0.5	0.98	Normal
Education	12.5	2.5	8	18	12	10	14	12	0.20	3.0	0.92	Normal
Income	1500	500	500	3000	1200	800	1800	1000	0.30	4.0	0.88	Normal
Marital Status	1.5	0.5	1	2	1	1	2	1	0.05	0.5	0.98	Normal
Occupation	2.5	1.5	1	5	2	1	3	2	0.10	1.0	0.96	Normal
Health Status	1.8	0.8	1	3	1	1	2	1	0.05	0.5	0.98	Normal
Stress Level	3.5	1.5	1	5	3	2	4	3	0.15	2.5	0.95	Normal
Life Satisfaction	4.2	1.2	1	5	4	3	5	4	0.10	1.0	0.96	Normal
Work-Life Balance	3.8	1.0	1	5	3	2	4	3	0.15	2.5	0.95	Normal
Family Support	4.5	1.0	1	5	4	3	5	4	0.10	1.0	0.96	Normal
Community Involvement	2.8	1.2	1	5	2	1	3	2	0.15	2.5	0.95	Normal
Personal Growth	3.2	1.0	1	5	3	2	4	3	0.15	2.5	0.95	Normal
Overall Well-being	3.5	1.0	1	5	3	2	4	3	0.15	2.5	0.95	Normal